UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

Note to Reader

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply. EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, If unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

Jack E. Housenger, Acting Director
Special Review and Reregistration Division

October 21, 1999

MEMORANDUM

SUBJECT: **Trichlorfon**; Chemical No. 057901. HED's Revised Preliminary Human Health Risk Assessment for Trichlorfon, Case # 0104. DP Barcode: D260388.

From: Thurston G. Morton, Risk Assessor
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Thru: Susan V. Hummel, Branch Senior Scientist
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Attached is HED's revised preliminary human health risk assessment of the organophosphate insecticide, trichlorfon. This document reflects corrections in the toxicity classes under the Hazard Identification section. The disciplinary science chapters and other supporting documents for Trichlorfon are included as attachments as follows:

Report of the Hazard Identification Assessment Review Committee. J.Rowland/P. Wagner (6/2/99)
FQPA Safety Factor Recommendations for the Organophosphates. B. Tarplee/J. Rowland (8/6/98)
Cancer Assessment Document Evaluation of the Carcinogenic Potential of Trichlorfon (S. Diwan, 7/15/99)
Product & Residue Chemistry Chapter. T. Morton (6/24/99, D257225)
Toxicology Chapter. A. Khasawinah (8/9/99, D258023)
Occupational and Residential Exposure Assessment. T. Leighton (7/11/99, D257671)
Acute and Chronic Dietary Exposure and Risk Analyses for the HED Human Health Risk Assessment. T. Morton (7/6/99, D257486)
Review of Trichlorfon Incident Reports. J. Blondell/M. Spann (12/8/99)

1.0 EXECUTIVE SUMMARY

Trichlorfon [dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate] is a selective organophosphate insecticide used to control a variety of arthropod pests including cockroaches, crickets, silverfish, bedbugs, fleas, cattle grubs, flies, ticks, leafminers, and leaf-hoppers. Tolerances with no U.S. registration for residues of trichlorfon in/on food and feed items are currently expressed in terms of trichlorfon *per se* [40 CFR §180.198]. Existing tolerances are 0.1 (N) ppm for cattle meat, meat-by-products, and fat. Trichlorfon is available in granular, soluble concentrate, and wettable powder formulations. Trichlorfon is currently registered for non-agricultural uses such as commercial animal kennels, golf course turf, ornamental shrubs and plants, and ornamental and baitfish ponds. Trichlorfon is also registered for indoor non-food/non-feed areas such as greenhouses, agricultural/farm premises, and non-food contact areas of food and meat processing plants. Registered residential uses of trichlorfon include uses such as perimeter treatment around dwellings, harvester ant mound treatment, and application to residential lawns. There is also a registered foreign use of trichlorfon as a cattle pour-on which is classified as a food-use. Trichlorfon is not a restricted use pesticide and products are marketed for homeowner use.

HAZARD IDENTIFICATION

The toxicology database provides evidence that cholinesterase inhibition is the most sensitive biomarker of exposure to trichlorfon in humans and laboratory animals. Trichlorfon, like other organophosphates, causes anticholinesterase and other neurotoxic effects in all species tested, including humans, monkeys, dogs, rabbits, rats, and mice. Neurotoxicity has been observed in acute, subchronic, chronic, and developmental/reproductive toxicity studies. In general, based on animal studies, trichlorfon is acutely toxic via the oral route of exposure (Category II), has low inhalation and dermal toxicity (Category III), causes eye irritation (Category II), and is a moderate skin sensitizer. It causes mild skin irritation.

TOXICITY DOSES AND ENDPOINTS SELECTED FOR RISK ASSESSMENT

Cholinesterase inhibition was the toxicity endpoint chosen for the acute and chronic dietary; and short- and intermediate- term dermal and inhalation risk assessments for occupational and residential exposure.

On February 18, 1999, HED's Hazard Identification Assessment Review Committee (HIARC) evaluated the doses and toxicology endpoints selected for trichlorfon based solely on animal toxicity studies. For acute dietary risk assessment, the NOAEL of 10 mg/kg/day from an acute neurotoxicity study in rats was chosen based on clinical signs, alterations in Functional Observation Battery (FOB), decreased motor activity, and significant plasma, red blood cell (RBC), and brain cholinesterase inhibition at 50 mg/kg/day (LOAEL).The acute Population Adjusted Dose (aPAD) was 0.01 mg/kg/day (acute RfD 0.1 mg/kg/day ÷ 10X FQPA safety factor).

The HIARC reaffirmed use of an RfD of 0.002 mg/kg/day for dietary risk assessments based on

the results of a ten year chronic feeding study in monkeys in which the NOAEL was 0.2 mg/kg/day. The LOAEL of 1 mg/kg/day was based on brain cholinesterase in both sexes. The chronic Population Adjusted Dose (cPAD) was 0.0002 mg/kg/day (chronic RfD 0.002 mg/kg/day ÷ 10X FQPA safety factor).

For short- and intermediate-term dermal risk assessments, a dermal NOAEL of 100 mg/kg/day was selected based on significant depression in red blood cell cholinesterase activity at 300 mg/kg/day (LOAEL) in a 21-day dermal study in rabbits. For inhalation exposure risk assessment, a NOAEL of 0.0127 mg/L (3.45 mg/kg/day) was chosen based on decrease in red blood cell cholinesterase activity at 0.0354 mg/L (LOAEL) in a 21-day inhalation study in rats. The target MOE is 100 for occupational risk assessments. Because of the extra FQPA safety factor, the target MOE is 1000 for residential exposure risk assessments.

No chronic (long-term) residential use scenarios for trichlorfon were identified.

On February 17, 1999, the Cancer Assessment Review Committee (CARC) concluded that administration of trichlorfon was associated with a significant increase in mammary tumors in female CD-1 mice. The Committee classified Trichlorfon as **"not likely to be carcinogenic to humans at low doses, but is likely to be carcinogenic at high doses"** based on increased incidence of many types of tumors only at the high dose. The highest dose was considered excessive because of significant cholinesterase inhibition and increased mortality. Also, there was no dose response, no decrease in latency, and there were no precursor changes.

FQPA Safety Factor

The FQPA Safety Factor Committee determined that the 10x FQPA safety factor is retained for the protection of infants and children. The determination was based on a number of factors including occurrence of neuropathology, as well as the presence of data gaps. Neurotoxicity concerns include the presence of organophosphate induced delayed neurotoxicity (OPIDN) and neuropathology in hens. Data gaps include a prenatal developmental toxicity study in rats and a developmental neurotoxicity study in rats. The committee determined that the factor should be applied for all non-occupational exposure scenarios and all population subgroups.

Dietary Exposure and Risk Assessment (General Population)

The only food use for trichlorfon is a pour-on use on imported cattle. The nature of the residue in cattle is not completely understood and additional data are required. A residue analytical method as well as magnitude of residue data from dermal applications may be required if additional residues of concern other than trichlorfon *per se* are determined by the HED Metabolism Assessment Review Committee. To compensate for inadequate data on the nature of the residue study and magnitude of residue study, HED has reassessed tolerances at the maximum level of trichlorfon *per se* found in a cattle metabolism study which was conducted at same dermal dosing level as the magnitude of residue study (DDVP was not a significant residue in the metabolism

study).

A chronic and acute dietary analysis was conducted using reassessed tolerances and percent of beef/veal imported, which was the only refinement utilized. The Biological and Economic Analysis Division (BEAD) provided information on the percent of beef/veal imported into the U.S. The acute probabilistic/Monte Carlo type dietary risk estimate for trichlorfon is below the Agency's level of concern at the 99.9th percentile (<100 % acute Population Adjusted Dose) for all population subgroups (17.6 % aPAD was occupied for Children 1-6 yrs, the most highly exposed subgroup). When compared to the chronic Population Adjusted Dose (cPAD) for trichlorfon, the estimated chronic dietary exposure based on reassessed tolerances for residues of trichlorfon is below HED's level of concern (<100 % cPAD) for all population subgroups (24.3 % cPAD for Children 1-6 yrs, the most highly exposed subgroup).

Drinking Water

Acute Drinking Water Level of Concerns (DWLOCs) were calculated based on the acute dietary (food) exposure and default body weights and water consumption figures. Acute DWLOCs were exceeded by EFED's surface water estimated environmental concentrations (EECs) (GENEEC, Tier 1) indicating a potential exposure concern. Groundwater EECs (SCI-GROW) did not exceed the calculated acute DWLOC. The acute DWLOC was 82 ppb for the most highly exposed population subgroup (Children 1-6 yrs) while the GENEEC and SCI-GROW estimated environmental concentrations (EECs) were 773 and 0.27 ppb, respectively. Because no refined screening models are available for turfgrass, EFED can only provide Tier 1 (GENEEC) EECs for trichlorfon.

Chronic DWLOCs were exceeded by EFED's surface water estimated environmental concentrations (EECs) (GENEEC, Tier 1) indicating a potential exposure concern. Groundwater EECs (SCI-GROW) did not exceed the calculated acute DWLOC. The chronic DWLOC was 1.5 ppb for the most highly exposed population subgroup (Children 1-6 yrs) while the GENEEC and SCI-GROW EECs were 151 and 0.27 ppb, respectively.

The Environmental Fate and Effects Division (EFED) used the highest application rate allowed on approved labels (8 lb ai/acre) to generate surface water (GENEEC) and groundwater (SCI-GROW) model EECs. Information on actual use rates and acreage treated were not available and therefore, only the maximum label rate (8 lb ai/acre rate) and maximum default acreage was used in the assessment. Also, there is no approved PRZM-EXAMS model scenario for turf therefore, refinement of the GENEEC model number is not possible. No trichlorfon water monitoring data are available.

Occupational Exposure and Risk Assessment

HED has identified 11 major exposure scenarios for which there is potential for occupational handler exposure during mixing, loading, and applying products containing trichlorfon to non-

agricultural use sites. These occupational scenarios reflect a broad range of application equipment, application methods, and use sites. The scenarios were classified as short-term (1-7 days) and intermediate-term (1 week to several months) based on the frequency of exposure. A long term exposure duration is not expected. No chemical-specific handler exposure data were submitted in support of the reregistration of trichlorfon. Therefore, an exposure assessment for each scenario was developed, where appropriate data are available, using the *Pesticide Handlers Exposure Database (PHED) Version 1.1*. The uncertainty factor and target Margin of Exposure (MOE) for occupational workers is 100 for short- and intermediate-term dermal and inhalation risks. MOEs below this level would represent a risk concern for the Agency.

With additional PPE and/or engineering controls, all but 1 of the 11 use scenarios have total MOEs (inhalation plus dermal) greater than 100. The one scenario that does not exceed a total MOE (inhalation plus dermal) of 100 is for scenario #6 (mixing/loading/applying with a low pressure handwand for commercial ponds/tanks). Total MOEs (inhalation plus dermal) for this scenario with PPE range from 27 to 120 depending on the size of the pond and the application rate. Engineering controls are not feasible for this use pattern. Refer to Table 10 for specific MOEs with and without PPE/engineering controls.

No chemical-specific postapplication human reentry or transferable residue data were submitted in support of the reregistration of trichlorfon. Details of the postapplication exposure and risk assessment for occupational workers are presented in the disciplinary chapter attached in the appendix. In summary, the postapplication exposure to golf course workers who mow and maintain turfgrass on the day of application does not exceed HED's level of concern because the MOE is greater than 100. However, entry by workers in ornamental nurseries following treatments at a 3 lb ai/acre application rate do not reach a MOE of 100 until day 20 for cutting, harvesting, transplanting, pruning, or balling/burlapping; until day 11 for irrigating; and until day 7 for sorting and packing. Furthermore, entry by workers in ornamental nurseries following treatments at the 6 lb ai/acre application rate do not reach a MOE of 100 until day 26 for cutting, harvesting, transplanting, pruning, balling/burlapping; until day 18 for irrigating; and until day 13 for sorting and packing.

Residential Exposure and Risk Assessment

Potential trichlorfon residential use sites include lawns and perimeters of homes. Residential handler exposure to trichlorfon residues via dermal and inhalation routes can occur during handling, mixing, loading, and applying activities. The exposure duration of these activities was classified as short-term (1-7 days) because trichlorfon is not expected to be used more than 7 consecutive days by a homeowner therefore, an intermediate-term risk assessment would not be calculated. PHED values used to estimate daily unit exposure values were taken from the *Standard Operating Procedures (SOPs) for Residential Exposure Assessments (December 1997).* The uncertainty factor and target MOE for residential assessments is 1,000 (10X for inter-species extrapolation, 10X for intra-species variability, and 10X FQPA safety factor) for short-term dermal and inhalation risks. MOEs below this level would represent a risk concern for the

Agency.

MOEs are greater than 1000 for loading/applying granules to building perimeters using a "push-type" broadcast spreader and applying granules to building perimeters using "hand broadcast" method (minimum rate only). The MOEs are less than 1,000 for loading/applying granules to residential lawns using a "push-type" broadcast spreader at the lowest application rate examined (MOE=810) and at the maximum label rate (MOE=540); applying granules to building perimeters using "hand broadcast" method at the maximum label rate (MOE=450); and applying granules to ant mounds using "hand broadcast" method at the lowest application rate examined (MOE=240) and maximum label rate (MOE=130).

EPA has determined that there are potential postapplication exposures to residents entering treated lawns. There is a potential postapplication exposure for the dermal route along with inadvertent oral exposure to children from incidential ingestion of trichlorfon-treated grass and/or granules. For residential postapplication activities, the exposure duration is expected to be short- to intermediate-term. No chemical-specific postapplication human reentry or transferable residue data were submitted in support of the reregistration of trichlorfon. Therefore, post-application exposures to residents were estimated using assumptions from the Standard Operating Procedures (SOPs) for Residential Exposure Assessments with refinements of the transferable residues as cited in the disciplinary chapter. MOEs do not exceed HED's level of concern for adults and youths playing 18 holes of golf on trichlorfon treated golf courses. Additionally, MOEs are adequate for hand-to-mouth activity on the lawn at the low label application rate (MOE = 1,400), and incidential ingestion of treated grass and/or soil. This screening level assessment however, does indicate a potential concern (i.e., MOEs less than 1,000) for the hand-to-mouth activity on the lawn at the maximum label application rate (MOE = 30), and the potential ingestion of granules. Also, MOEs exceed HED's level of concern for adults' and toddlers' activity of playing on treated lawns at both the low and high end estimates (MOEs < 1000).

Aggregate Risk Assessment

a. Acute Aggregate Risk Estimate and Exposure Assessment

Acute aggregate risk estimates exceed HED's level of concern if the source of water is surface water, but do not exceed HED's level of concern if the source of water is subsurface. Acute food exposure estimate does not exceed HED's level of concern. For the most highly exposed subpopulation, children 1-6 years old, 18 % of the aPAD is occupied. The EECs for surface water (GENEEC) were greater than the acute drinking water levels of concern (DWLOCs). Refinement using the PRZM-EXAMS (Tier II) surface water model is not possible due to the fact that an approved turf scenario in PRZM-EXAMS is not available. The EECs for groundwater (SCI-GROW) were less than the acute DWLOC's, indicating that acute aggregate exposure to trichlorfon in food and water is not of concern if the source of water is groundwater.

b. Short- to Intermediate-Term Aggregate Risk Estimates and Exposure Assessment

Two short to intermediate-term scenarios were identified: Loading/Applying with a push type spreader to building perimeters (0.0000125 and 0.000062 lb ai/ft^2) and dermal postapplication exposure to a youth golfer playing 18 holes of golf on trichlorfon treated golf courses (5.4 lb ai/acre) when aggregated with chronic food and water exposure do not exceed HED's level of concern. Applying granulars by hand to building perimeters (0.0000125 lb ai/ft^2) when aggregated with chronic food and water exposure slightly exceeds HED's level of concern. Loading/Applying with a push type spreader to turf (5.4 and 8.2 lb ai/acre) and applying granulars by hand to harvester ant mounds (0.013 and 0.025 lb ai/mound) both have MOEs less than 1000 so therefore, aggregating these applications exposures with chronic food and water exposure would only increase HED's concern.

c. Chronic Aggregate Risk Estimate and Exposure Assessment

Chronic aggregate risk estimates exceed HED's level of concern if the source of water is surface water, but do not exceed HED's level of concern if the source of water is subsurface. Chronic food exposure estimate does not exceed HED's level of concern. For the most highly exposed subpopulation, children 1-6 years old, 24 % of the cPAD is occupied. The EECs for surface water (GENEEC) were greater than the chronic DWLOCs, indicating that chronic aggregate exposure to trichlorfon exceeds HED's level of concern if the source of water is surface water. The EECs for groundwater (SCI-GROW) were less than the chronic DWLOC's, indicating that chronic aggregate exposure to trichlorfon in food and water is not of concern if the source of water is groundwater.

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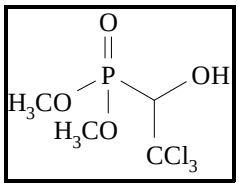
2.0 PHYSICAL/CHEMICAL PROPERTIES CHARACTERIZATION

DESCRIPTION OF CHEMICAL

Trichlorfon [dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate] is an organophosphorus insecticide.



Empirical Formula:	$C_4H_8O_4Cl_3P$
Molecular Weight:	257.6
CAS Registry No.:	52-68-6
PC Code :	057901

IDENTIFICATION OF ACTIVE INGREDIENT

Technical trichlorfon is a white crystalline solid with a melting point of 75-84 °C. Trichlorfon is soluble in water, dichloromethane, 2-propanol, and toluene, and nearly insoluble in n-hexane.

3.0 HAZARD CHARACTERIZATION

3.1 Hazard Profile

The toxicological data base for trichlorfon will support reregistration eligibility. For a detailed discussion of submitted toxicity studies refer to the HED Trichlorfon Toxicology Chapter (A. Khasawinah, 8/9/99, D258023).

Table 1. SUMMARY OF TOXICOLOGY ENDPOINT SELECTION

EXPOSURE SCENARIO	DOSE (mg/kg/day)	ENDPOINT	STUDY	Target MOE
Acute Dietary	NOAEL=10 UF = 100 FQPA = 10	Clinical signs, plasma, RBC and brain cholinesterase inhibition	Acute Neurotoxicity-Rat Study	Not Relevant
	Acute RfD =0.1 mg/kg/day AcutePAD = 0.01 mg/kg/day			
Chronic Dietary	NOAEL=0.2 UF = 100 FQPA = 10	Brain cholinesterase inhibition in both sexes	Chronic Toxicity-Monkeys	Not Relevant
	Chronic RfD =0.002 mg/kg/day ChronicPAD = 0.0002 mg/kg/day			
Dermal Absorption	Estimated at 10% based upon the comparisons of LOAELs in the oral developmental toxicity (35 mg/kg/day) and the 21-day dermal toxicity (300 mg/kg/day) in rabbits.			
Short-Term (Dermal)	Dermal NOAEL=100	Red blood cell cholinesterase inhibition	21 Day Dermal - Rabbit	100[b]
Intermediate-Term (Dermal)	Dermal NOAEL=100	Red blood cell cholinesterase inhibition	21 Day Dermal - Rabbit	100[b]
Long-Term (Dermal)[a]	Oral NOAEL=0.2	Brain cholinesterase inhibition in both sexes	Chronic Toxicity-Monkeys	100
Inhalation (Any Time Period)	Inhalation NOAEL= 0.0127 mg/L[c]	Plasma, red blood cell, and brain cholinesterase inhibition	21-Day Inhalation-Rat	100[b]

[a] Since an oral value was selected, a 10% dermal absorption factor should be used for route to route extrapolation.
[b] Target MOE = 1000 for residential scenarios.
[c] 3.45 mg/kg/day = NOAEL(0.0127) * respiration rate of a young adult Wistar rat (8.46 L/hr) * study daily exposure duration (6 hr/day) ÷ body weight of a young adult Wistar rat (0.187 kg).

3.2 FQPA Considerations

The FQPA Safety Factor Committee met on June 15 and 16, 1998 to evaluate the hazard and exposure data for trichlorfon and recommend application of the FQPA Safety Factor (as required by Food Quality Protection Act of August 3, 1996), to ensure the protection of infants and children from exposure to trichlorfon. The FQPA Safety Factor Committee determined that the 10x FQPA safety factor is required for the protection of infants and children from acute and chronic dietary exposure to trichlorfon. Specifically for trichlorfon, the safety factor is retained based on a number of factors including occurrence of neuropathology, as well as the presence of data gaps. Neurotoxicity concerns include the presence of OPIDN and neuropathology in hens. Data gaps include a prenatal developmental toxicity study in rats and a developmental

neurotoxicity study in rats. Methods to assess dietary and non-occupational exposures are unlikely to underestimate exposure.

4.0. EXPOSURE ASSESSMENT

4.1 Summary of Registered Uses

Trichlorfon is currently registered for non-agricultural uses such as commercial animal kennels, golf course turf, ornamental shrubs and plants, and ornamental and baitfish ponds. Trichlorfon is also registered for indoor non-food/non-feed areas such as greenhouses, agricultural/farm premises, and non-food contact areas of food and meat processing plants. Registered residential uses of trichlorfon include uses such as perimeter treatment around dwellings, harvester ant mound treatment, and application to residential lawns. There is also a registered foreign use of trichlorfon as a cattle pour-on.

Manufacturing-Use Products

A search of the Reference Files System (REFS) conducted 6/7/99 identified the following trichlorfon manufacturing-use products (MPs) registered under PC Code 057901 to Bayer Corporation: a 98% technical product (T; EPA Reg. No. 3125-9), and an 80% formulation intermediate (FI; EPA Reg. No. 3125-371). These products are the only MPs subject to a reregistration eligibility decision. Provided that the registrant submits the data required in the product chemistry summary tables for the trichlorfon MPs, the Agency has no objections to the reregistration of trichlorfon with respect to product chemistry data requirements.

A REFs search conducted 6/7/99 and a LUIS Report dated 2/19/99 identified 13 trichlorfon end-use products (EPs). Some of the EPs listed in Table 2 carry use directions for surface spray or broadcast treatment in farm buildings (including dairy barns) and food-handling establishments; however, these uses are classified as non-food uses because adequate restrictions exist regarding the potential for residue transfer. When trichlorfon is applied in farm buildings, animals are removed before treatment; there are label restrictions against contamination of milk, milk-handling equipment, feed, drinking water, litter, feed troughs, and portions of buildings where animals can lick the treated surface.

Table 2. Currently Registered Trichlorfon End-Use Products (REFS search dated 6/7/99).

Registrant	EPA Reg. No.	% AI and Formulation	Label Date	Food/Feed Uses?
Prentiss Inc.	655-790	5% G	11/97	No
	655-791	5% G	11/97	No
Bayer Corporation	3125-184	80% WP	11/93	No
	3125-400	6.2% G	3/94	No
	3125-406	6.2% G	9/90	No
	3125-449	80% SP	6/96	No
	3125-507	6.2% G	11/97	No
The Andersons	8660-71	6.2% G	10/92	No
The Andersons Lawn & Fertilizer Division	9198-110	6.2% G	7/92	No
Drexel Chemical Co.	19713-220	5% G	1/96	No
Howard Johnson's Enterprises, Inc.	32802-29	6.2% G	8/95	No
Arkansas Bait & Ornamental Fish Growers Association	AR98000300	80% WP	4/98	No
California Aquaculture Assoc.	CA98001400	80% WP	7/98	No

4.2 Food Exposure

The nature of the residue is not completely understood (T. Morton, 6/24/99, D244279). Additional data are required pertaining to the nature of the residue in cattle (dermal treatment). Trichlorfon *per se* (maximum of 0.39 ppm of TRR in subcutaneous fat near the dose site), dichlorvos (maximum of 0.04 ppm of TRR in subcutaneous fat near the dose site), desmethyl DDVP (maximum of 0.28 ppm of TRR in loin muscle), dichloroacetic acid (maximum of 0.35 ppm of TRR in subcutaneous fat near the dose site), and a polar compound (maximum of 0.38 ppm of TRR in the liver) were residues identified in a metabolism study conducted at approximately the labeled rate. However, a greater percentage of the total radioactive residue must be identified in liver and muscle. Only 42-55 % of the TRR was identified/characterized in the liver while only 23-65 % of the TRR was identified in the muscle samples. In addition, the polar compound must be identified in the fat (24 %), kidney (57 %), and liver (49 %) samples. Once the nature of the residue is complete, the results will be presented to the HED Metabolism Assessment Review Committee for determination of the trichlorfon residues of concern in cattle.

Adequate methodology is available for enforcement of tolerances with no U.S. registration for residues of trichlorfon *per se* in/on cattle commodities. A GC/ECD method for trichlorfon is included in PAM, Vol. II as Method B. Sensitivity is 0.1 ppm. A revised residue analytical method may be required if additional residues of concern are determined.

Storage stability of trichlorfon in tissues of cattle is adequate (T. Morton, 6/24/99, D244279). Trichlorfon residues are stable in cattle tissues for 3 months under frozen conditions (-80° C). Dichlorvos residues are stable in cattle muscle and fat for 3 months under frozen conditions (-80° C). Dichlorvos recoveries in fortified liver and kidney samples were significantly lower than those from the concurrent recovery samples. Results from a separate short time room temperature

storage stability study showed dichlorvos undergoes degradation in a short time (<2 hours) between fortification and extracting.

Residues of trichlorfon and dichlorvos (only residues analyzed) were < 0.05 ppm in livestock commodities at pre-slaughter intervals of 1, 3, and 7 days in a dermal magnitude of the residue study conducted at approximately the labeled rate (T. Morton, 6/24/99, D244279). In the nature of the residue in cattle study, trichlorfon *per se* was detected at relatively high levels in loin muscle and subcutaneous fat near the dose site. There was no explanation on the discrepancy of the trichlorfon residues between the metabolism study and the magnitude of the residue study. The registrant is required to explain the difference between concentration of trichlorfon *per se* found in the magnitude of residue study and that which was found in the nature of the residue study.

Additional storage stability and residue data may be required if additional residues of concern are identified by the HED Metabolism Assessment Review Committee.

Table 3. Residue Chemistry Science Assessments for Reregistration of Trichlorfon.

GLN: Data Requirements	Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References
860.1200: Directions for Use	N/A = Not Applicable	No	
860.1300: Plant Metabolism	N/A	N/A	
860.1300: Animal Metabolism	N/A	Yes[a]	44500701 44500702 [C]
860.1340: Residue Analytical Methods	N/A	No[b]	44500704 [C]
860.1380: Storage Stability	N/A	No[b]	44781401 [C]
860.1400: Water, fish, and irrigated crops	N/A	N/A	
860.1460: Food handling	N/A	N/A	
860.1480: Meat, milk, poultry, and eggs	§180.198	No[b]	44500703 [C]
860.1500: Crop field trials	N/A	N/A	
860.1520: Processed food/feed	N/A	N/A	
860.1850: Confined accumulation in rotational crops	N/A	N/A	
860.1900: Field accumulation in rotational crops	N/A	N/A	

[a] Additional data required.
[b] Additional data may be required if additional residues of concern are identified by the HED Metabolism Assessment Review Committee.
[C] T. Morton, 6/24/99, D244279.

4.2.1 Tolerance Reassessment Summary

The tolerances listed in [40 CFR §180.198] are for residues of trichlorfon in/on animal products. A footnote must be added to the tolerance listing in [40 CFR §180.198] that states "There are no United States registrations for cattle commodities as of 6/24/99." The registrant is required to explain the difference in concentration of trichlorfon *per se* found in the magnitude of residue study in cattle versus the concentration of trichlorfon *per se* found in the nature of the residue in cattle study. Therefore, until an explanation is received and considered adequate, HED will reassess the tolerances for trichlorfon in cattle, fat; cattle, meat by products; and cattle, meat to the concentrations listed in Table 4. These concentrations were the maximum residues of trichlorfon *per se* in the nature of the residue in cattle study which was conducted at the same dermal dosing level as the magnitude of residue study.

Table 4. Tolerance Reassessment Summary for Trichlorfon.

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)
Tolerances listed under 40 CFR §180.198		
Cattle, fat	0.1 (N)	0.5
Cattle, mbyp	0.1 (N)	0.1
Cattle, meat	0.1 (N)	0.2

4.2.2 Codex Harmonization

There are no Codex Maximum Residue Levels for residues of trichlorfon. Thus harmonization is not an issue at this time.

4.2.3 Dietary Exposure Reassessment

Sufficient residue data are available to estimate that the existing tolerances with no U.S. registration for cattle, meat and cattle, fat are likely to require modification. For this document, the dietary exposure estimate will include residues of trichlorfon *per se*. Once the residues of concern are determined by the HED metabolism committee the dietary exposure may have to be reassessed. Reevaluated tolerances in addition to % beef/veal imported into the U.S. will be used in the dietary exposure analysis.

Consumption Data

HED conducts dietary risk assessments using the Dietary Exposure Evaluation Model (DEEM™), which incorporates consumption data generated in USDA's Continuing Surveys of Food Intakes by Individuals (CSFII), 1989-1992. For acute dietary risk assessments, the entire distribution of single day food consumption events is combined with either a single residue level (deterministic analysis, risk at 95th percentile of exposure reported) or a distribution of residues (probabilistic analysis, referred to as "Monte Carlo," risk at 99.9th percentile of exposure reported) to obtain a distribution of exposure in mg/kg/day. For chronic dietary risk assessments, the three-day average of consumption for each sub-population is combined with residues in

commodities to determine average exposure in mg/kg/day.

Trichlorfon Residue Data

Refined residue estimates for acute and chronic dietary exposure analysis, generated in conjunction with the HED Chemistry Chapter (6/24/99) have been updated with the revised usage information and used for this dietary analysis. Supported food/feed uses of the insecticide trichlorfon are limited to dermal pour-on uses on cattle outside the United States. No other food/feed uses, foreign or domestic are to be supported through reregistration. The Biological and Economic Analysis Division (OPP/BEAD) has provided import information for beef/veal stating that 10.3% of the beef/veal consumption is from imports. HED is assuming 100 % of the imported beef would be treated which is a conservative estimate.

4.2.4 Acute Dietary Exposure Assessment

Estimated acute dietary exposure is below HED's level of concern. Use of reassessed tolerance-level residues and assuming 10 % of beef/veal consumed is imported (BEAD supplied import data) in the assessment resulted in estimated dietary exposure corresponding to 11 % aPAD for the general US population, and 18 % aPAD for children 1-6 years old, the most highly exposed population subgroup (Table 5). This was a probabilistic dietary exposure assessment using % of beef/veal imported as the only refinement.

Table 5. **Population Adjusted Dose** Acute Dietary Exposure Results for Trichlorfon (PAD = 0.01 mg/kg/day) using reassessed tolerances and 10 % beef/veal imported.

Subgroups	95th Percentile Exposure (%aPAD)	99th Percentile Exposure (%aPAD)	99.9th Percentile Exposure (%aPAD)
U.S. Population (48 states)	0.000168 (1.7%)	0.000480 (4.8%)	0.001086 (10.9%)
Non-nursing infants (<1 year)	0.000005 (0.1%)	0.000364 (3.6%)	0.001452 (14.5%)
Children (1-6 years)	0.000340 (3.4%)	0.000891 (8.9%)	0.001761 (17.6%)
Females (13-19 yrs/not preg/not nursing)	0.000157 (1.6%)	0.000419 (4.2%)	0.001004 (10.0%)
Males (13-19 years)	0.000213 (2.1%)	0.000485 (4.9%)	0.000971 (9.7%)

4.2.5 Chronic Non-cancer Dietary Exposure Assessment

Estimated chronic dietary exposure is below HED's level of concern. Use of reassessed tolerances results in a maximum exposure of 24 % of the chronic PAD (% cPAD) for children 1-6. Dietary exposure for the general US population was estimated to be 12 % cPAD.

Table 6. Acute and Chronic (Non-Cancer) Dietary Exposure/Risk.

Population Subgroup	Acute **Reassessed Tolerances (Probabilistic)** (99.9th %-ile)		Chronic **Reassessed Tolerances**	
	Exposure (mg/kg/day)	% aPAD	Exposure (mg/kg/day)	% cPAD
U.S. Population	0.001086	10.9	0.000025	12
All infants (<1 yr)	0.001354	13.5	0.000011	5.4
Nursing infants (<1 yr)	0.001228	12.3	0.000009	4.7
Non-nursing infants (<1 yr)	0.001452	14.5	0.000011	5.7
Children (1-6 yrs)	0.001761	17.6	0.000049	24
Children (7-12 yrs)	0.001249	12.5	0.000035	18
Females (13-19 yrs)	0.001004	10.0	0.000023	11
Females (13+ preg/not nursing)	0.000816	8.2	0.000019	9.6
Males (13-19 yrs)	0.000971	9.7	0.000030	15
Males (20+ yrs)	0.000840	8.4	0.000023	12

4.2.2 Drinking Water Exposure

Since no trichlorfon water monitoring data was available, Environmental Fate and Effects Division (EFED) provided HED with modeling data on trichlorfon and DDVP (degradate of trichlorfon) in surface water and groundwater. EFED model estimates used 1, 3, and 52 applications of trichlorfon per year in the absence of a limit on maximum applications per year on the trichlorfon labels. HED is assuming the 3 applications of trichlorfon per year is suitable for use in the calculation of DWLOCs and aggregate exposure. GENEEC and SCI-GROW data are as follows:

Table 7. GENEEC and SCI-GROW EECs (ug/L) for trichlorfon use on turfgrass.

Model	EECs
Surface Water (GENEEC)	Peak = 1000 ppb (DDVP included) 773 ppb (Trichlorfon only) Average 56 day = 161 ppb (DDVP included)* 151 ppb (Trichlorfon only)
Groundwater (SCI-GROW)	0.27 ppb

* Value reported by EFED was 483 ppb, current HED policy states that the average 56 day GENEEC value should be divided by 3 for chronic DWLOC calculation

GENEEC is not an ideal tool for drinking water exposure assessments. Surface-water-sourced drinking water tends to come from bodies of water that, are substantially larger than a 1-hectare pond. Furthermore, GENEEC assumes that essentially the whole basin receives an application of the chemical. In virtually all cases, basins large enough to support a drinking water facility will contain a substantial fraction of area that does not receive the chemical. Furthermore, there is always at least some flow (in a river) or turn over (in a reservoir or lake) of the water so the persistence of the chemical near the drinking water facility is usually over estimated by GENEEC. Given all this, GENEEC does provide an upper bound on the concentration of pesticide that could be found in drinking water and therefore can be appropriately used in screening calculations.

4.2.2.1 DWLOCs for Chronic (Non-Cancer) Exposure

Chronic DWLOCs were calculated based on the chronic dietary (food) exposure and default body weights and water consumption figures. The EECs for surface water (GENEEC) were greater than the chronic DWLOCs, indicating that chronic exposure to trichlorfon in food and water exceeds HED's level of concern. The EECs for groundwater (SCI-GROW) were less than the chronic DWLOC's, indicating that chronic exposure to trichlorfon in food and water is less than HED's level of concern. The Agency's default body weights and water consumption values used to calculate DWLOCs are as follows: 70 kg/2L (adult male), 60 kg/2L (adult female), and 10 kg/1L (child). To calculate the chronic DWLOC, the chronic dietary food exposure was subtracted from the chronic PAD using the equation:

$$DWLOC_{chronic} = \frac{[\text{chronic water exposure (mg/kg/day)} \times \text{(body weight)}]}{[\text{consumption (L)} \times 10^{-3}\ \text{mg/}\mu\text{g}]}$$

where chronic water exposure (mg/kg/day) = [cPAD - (chronic food (mg/kg/day)]

Table 8. Drinking Water Levels of Comparison for Chronic Dietary Exposure.

Population Subgroup	Chronic PAD (mg/kg/day)	Food Exposure (mg/kg/day)	Max. Water Exposure (mg/kg/day)	$DWLOC_{chronic}$ (ug/L)	GENEEC (ug/L)	SCI-GROW (ug/L)
US Population	0.0002	0.000025	0.000175	6.1	161	0.27
Children 1-6	0.0002	0.000049	0.000151	1.5	161	0.27
Females 13-19	0.0002	0.000023	0.000177	5.3	161	0.27
Males 13-19	0.0002	0.000030	0.00017	6.0	161	0.27

4.2.2.2 DWLOCs for Acute Exposure

Acute DWLOCs were calculated based on the acute dietary (food) exposure and default body weights and water consumption figures. The EECs for surface water (GENEEC) were greater than the acute DWLOCs, indicating that acute aggregate exposure to trichlorfon in food and water exceeds HED's level of concern. The acute DWLOC for Children 1-6 years (highest exposed population) is 82 ppb. The GENEEC surface water value is 1000 ppb.

The EECs for groundwater (SCI-GROW) were less than the acute DWLOC's, indicating that acute aggregate exposure to trichlorfon in food and water is less than HED's level of concern. The Agency's default body weights and water consumption values used to calculate DWLOCs are as follows: 70 kg/2L (adult male), 60 kg/2L (adult female), and 10 kg/1L (child). To calculate the DWLOC, the acute dietary food exposure was subtracted from the acute PAD using the equation:

$$DWLOC_{acute} = \frac{\text{[acute water exposure (mg/kg/day) x (body weight)]}}{\text{[consumption (L) x } 10^{-3} \text{ mg/ } \mu\text{g]}}$$

where acute water exposure (mg/kg/day) = [aPAD - (acute food (mg/kg/day)]

Table 9. Drinking Water Levels of Comparison for Acute Dietary Exposure.

Population Subgroup	Acute PAD (mg/kg/day)	Food Exposure (mg/kg/day)	Max. Water Exposure (mg/kg/day)	$DWLOC_{acute}$ (ug/L)	GENEEC (ug/L)	SCI-GROW (ug/L)
US Population	0.01	0.001086	0.008914	312	1000	0.27
Children 1-6	0.01	0.001761	0.008239	82	1000	0.27
Females 13-19	0.01	0.001004	0.008996	270	1000	0.27
Males 13-19	0.01	0.000971	0.009029	316	1000	0.27

4.3 Non-Dietary Exposure

At this time, products containing trichlorfon are registered for both homeowner and occupational

uses. Trichlorfon is currently registered for the following terrestrial non-food uses: agricultural uncultivated areas, commercial animal kennels and sleeping quarters, recreational area and ornamental lawns, golf course turf, outdoor commercial/institutional/industrial premises and equipment, commercial freshwater ponds/tanks, nonagricultural uncultivated areas and soils, ornamental and/or shade trees, ornamental herbaceous and non-flowering plants, ornamental woody shrubs and vines, paths and patios, outdoor refuse/solid waste sites.

Indoor non-food uses of trichlorfon include the following: greenhouses, agricultural/farm premises, cattle feedlots, dairy farm milk storage rooms/houses/sheds, dairy farm milking stalls/-parlors, non-food contact areas of food processing plant premises, nonfood areas of eating establishments, food/grocery/marketing/ storage/distribution facility premise, household/domestic dwellings, indoor food handling areas, non-food contact meat processing plant premises, non-food contact areas of poultry processing plant equipment, indoor commercial storage/warehouses premises. [All of these sites have required, and will continue to require, label restrictions prohibiting contamination of food/feed or food/feed handling equipment and restricting use to areas inaccessible to animals.]

Trichlorfon is applied to turf using groundboom sprayers, low-pressure handwand (spot treatment), backpack (spot treatment), and handgun sprayers, sprinkling can (spot treatment), push-type granular spreaders, and irrigation systems. Ornamental applications encompass groundboom sprayers (drench), and low- and high-pressure handwand and backpack sprayers. Pond treatments are assumed to be treated with a low pressure handwand. Outdoor perimeter treatments are assessed for soluble powders in water by watering can, through hand-held sprayers; dry baits can be “sprinkled” out of a cup or spoon or put onto cardboard or plastic or applied as a mound treatment for ants; and bait mixed with water and “sprinkled” out of a cup or watering can. Finally, treatments in and around buildings are assessed using low pressure handwand and backpack sprayers, and granular treatment to cracks, crevices and wall voids.

4.3.1 Occupational Handler Exposure Scenarios

HED has identified 11 major exposure scenarios for which there is potential for occupational handler exposure during mixing, loading, and applying products containing trichlorfon to non-agricultural use sites. These 11 handler scenarios include the following: (1) mixing/loading wettable powders for groundboom and chemigation applications; (2) applying with groundboom equipment; (3) mixing/loading/applying with groundboom equipment for drench application; (4) mixing/loading/applying with high pressure handwand sprayer; (5) mixing/loading/applying with handgun sprayer; (6) mixing/loading/applying with low-pressure handwand sprayer; (7) mixing/-loading/applying with backpack sprayer; (8) loading/applying with push-type spreader; (9) mixing/loading/applying with sprinkling can; (10) loading/applying with shaker can; and (11) applying granulars by hand. These occupational scenarios reflect a broad range of application equipment, application methods, and use sites. The scenarios were classified as short-term (1-7 days) and intermediate-term (1 week to several months) based primarily on the frequency of exposure. A long term exposure duration is not expected. The estimated exposures considered baseline protection (long pants and a long-sleeved shirt, no gloves, and an open cab or tractor),

additional personal protective equipment (PPE, which includes a double layer of clothing and gloves and/or a dust/mist respirator), and engineering controls (closed mixing/loading systems).

4.3.1.1 Occupational Handler Exposure Data Sources and Assumptions

No chemical-specific handler exposure data were submitted in support of the reregistration of trichlorfon. Therefore, an exposure assessment for each scenario was developed, where appropriate data are available, using the *Pesticide Handlers Exposure Database (PHED) Version 1.1*. PHED was designed by a task force consisting of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide Regulation, and member companies of the American Crop Protection Association. PHED is a generic database containing measured exposure data for workers involved in the handling or application of pesticides in the field. The basic assumption underlying the system is that exposure to pesticide handlers can be calculated using the monitored data as exposure is primarily a function of the physical parameters of the handling and application process (e.g., packaging type, application method, and clothing scenario). Users can select data from each major PHED file and construct exposure scenarios that are representative of the use of the chemical. However, to add consistency to the risk assessment process, the EPA in conjunction with the PHED task force has evaluated all data within the system and developed a surrogate exposure table that contains a series of standard unit exposure values for various occupational exposure scenarios (*PHED Surrogate Exposure Guide of May, 1997*). These standard unit exposure values are the basis for this assessment. The standard exposure values (i.e., the unit exposure values included in the exposure and risk assessment tables) are based on the "best fit" values calculated by PHED. As a result, the surrogate unit exposure values that serve as the basis for this assessment generally range from the geometric mean to the median of the selected dataset.

4.3.1.2 Occupational Handler Risk Characterization

Because the same toxic effects (i.e., cholinesterase inhibition) were selected for the assessment of dermal and inhalation risks, a combined total risk assessment was conducted for dermal and inhalation exposures. MOEs for occupational handlers were derived based upon comparison of dermal exposure estimates against the short- and intermediate-term NOAEL of 100 mg/kg/day from a 21-day dermal rabbit study and an inhalation NOAEL of 0.0127 mg/L (3.45 mg/kg/day) from a 21-day inhalation study in rats. Both the short and intermediate-term NOAELs were from route specific studies, and therefore, an absorption correction is not necessary. The uncertainty factor and target MOE for occupational workers is 100 for short- and intermediate-term dermal and inhalation risks. MOEs below this level would represent a risk concern for the Agency.

A summary of the short-term and intermediate-term risk estimates for baseline, additional PPE, and engineering controls is presented in Table 10. Specific dose levels and MOEs for dermal, inhalation, and total exposure/risk are presented in the disciplinary chapter attached as an appendix. Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, and open cab tractor. Additional PPE for dermal scenarios includes chemical resistant gloves and in some instances double layer of clothing (50% protection factor

for clothing). Only one scenario required engineering controls (i.e., scenario #1 required the use of water soluble packets for mixer/loaders supporting groundboom application).

All but one of the use scenarios have total MOEs greater than 100. The one scenario that does not exceed a total MOE of 100 is for scenario #6 (mixing/loading/applying with a low pressure handwand for commercial ponds/tanks). Total MOEs for this scenario range from 27 to 120 depending on the size of the pond and the application rate.

Short- and Intermediate-Term Risk Characterization: The estimates for short- and intermediate-term dermal and inhalation risks have been combined because dermal and inhalation endpoint effects are the same.

> **Total** MOEs greater than 100 at baseline for scenarios 2, 3, 8 (minimum rate), 10, and 11 ranged from 180 to 12,000. Additional PPE is necessary to reach a MOE of 100 for scenarios 4, 5, 6 (excluding ponds), and 8 (maximum rate). The PPE ranges from single layer of clothing with chemical resistant gloves to double layer of clothing, chemical resistant gloves, and a respirator. Some of the scenarios (i.e., 4, 5, 6, 7, and 11) do not have assessments at baseline because no data are available. Engineering controls are required to mitigate total exposure for scenario 1. The only MOEs that did not exceed 100 are for various rates for scenario 6 (i.e., mixing/loading/applying with a low pressure handwand for fish pond uses). The MOEs for the fish pond use range from 27 to 120 depending on the rate and size of fish pond. Provided that trichlorfon short- and intermediate-term total exposures are mitigated for the above specified exposure scenarios with PPE and/or engineering controls, MOEs for dermal exposure/risk do not exceed HED's level of concern, except for the fish pond use.

A number of issues must be considered when interpreting the results of the occupational short- and intermediate-term risk assessment. For example, the acres treated or amount handled per day may vary depending on the target and application equipment. The following is a list of the assumptions used in the assessment:

- Golf course turfgrass and chemigation treatments: 40 acres for occupational handlers;
- turfgrass broadcast treatments: 5 acres for occupational handlers;
- turfgrass perimeter/spot treatments: 100 sq ft for occupational handlers using a sprinkler can, and 1,000 ft^2 for hand-applied treatments, and 5 granule shaker cans for occupational handlers;
- ant mound treatments: 14 mounds for occupational handlers;
- Narcissus drench treatment (groundboom): 1,000 gallons for occupational handlers;
- Ornamental treatments: 1,000 gallons high-pressure handwand, 40 gallons for low-pressure handwand and backpack for occupational handlers;
- Pond/aquatic tank treatments: large pond (volume = 15 acre-feet) and small pond (volume = 7.5 acre-feet) for occupational handlers; and
- Buildings: 20,000 sq ft for occupational handlers.

Table 10. Summary of Occupational Handler Total Risk for Trichlorfon at Baseline, with PPE, and Engineering Controls

Exposure Scenario (Scenario #)	Crop Type/Use	Short- and Intermediate-Term Total MOE (UF = 100)			Input Parameters and Potential Mitigation Measures
		Baseline	PPE	Engineering Controls	
MIXER/LOADER EXPOSURE					
Mixing/Loading Soluble Powder for Groundboom and Chemigation Application (1)	Turf	4	51	1,300	The high application rate of 8.2 lb ai/acre is driving the assessment.
APPLICATOR EXPOSURES					
Applying Spray to Golf Courses with a Groundboom Sprayer (2)	Turf	600	NA	NA	NA
MIXER/LOADER/APPLICATOR EXPOSURES					
Mixing/Loading/Applying with a Groundboom as a Drench (3)	Narcissus	1,700	NA	NA	NA
Mixing/Loading/Applying with a High Pressure Handwand Sprayer (4)	Ornamentals	No Data	150	NA	PPE includes single layer clothing and chemical-resistant gloves, open systems.
Mixing/Loading/Applying with a Handgun Sprayer (5)	Turf	No Data	450	NA	PPE includes single layer clothing and chemical-resistant gloves, open systems.
Mixing/Loading/Applying with a Low Pressure Handwand (soluble powder formulation) (6)	Turf (Spot Treat)	No Data	910	NA	PPE includes single layer clothing and chemical-resistant gloves, open systems.
	Ornamentals	No Data	290	NA	PPE includes single layer clothing and chemical-resistant gloves, open systems.
	Livestock areas	No Data	120	NA	PPE includes single layer clothing, chemical-resistant gloves, and a dust/mist **respirator**, open systems.
	Ponds	No Data	27 to 120	NA	PPE includes double layer clothing, chemical-resistant gloves, and a dust/mist **respirator**, open systems.
Mixing/Loading/Applying with a Backpack Sprayer (7)	Turf (Spot Treat)	No Data	11,000	NA	PPE includes single layer clothing and chemical-resistant gloves, open systems. Exposure for the no glove scenario is not available.
	Ornamentals	No Data	3,500	NA	PPE includes single layer clothing and chemical-resistant gloves, open systems. Exposure for the no glove scenario is not available.
	Livestock areas	No Data	520	NA	PPE includes single layer clothing and chemical-resistant gloves, open systems. Exposure for the no glove scenario is not available.

Exposure Scenario (Scenario #)	Crop Type/Use	Short- and Intermediate-Term Total MOE (UF = 100)			Input Parameters and Potential Mitigation Measures
		Baseline	PPE	Engineering Controls	
Loading/Applying Granulars with a Push Type Spreader (8)	Turf - min. rate	410	NA	NA	Minimum label rate is 1.1 lb ai/acre
	Turf - max. rate	56	120	NA	The application rate of 8.1 lb ai/acre is driving the risk. PPE includes single layer clothing and chemical-resistant gloves, open systems.
Loading/Applying with a Sprinkling Can (9)	Turf (Spot Treat)	12,000	NA	NA	Exposure data for sprinkling cans does not exist. The garden hose end sprayer was used as a surrogate. Although this is not a representative estimate, it is believed not to underestimate the risk.
Mixing/Loading/Applying with a Shaker Can (10)	House perimeter	200	NA	NA	NA
Applying Granulars by Hand (11)	House perimeter	NA	1,200 to 4,900	NA	The scenario for spreading granulars by hand is based on non detect samples. PPE includes single layer clothing and chemical-resistant gloves.
	Ant mounds	180 to 340	NA	NA	

Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, and open cab tractor. Additional PPE for l dermal scenarios includes either single layer of clothing and chemical resistant gloves or double layer of clothing (50% protection factor for clothing) and chemical resistant gloves, as indicated above. Engineering controls includes closed mixing/loading, single layer clothing, chemical resistant gloves.

4.3.1.3 Occupational Postapplication Exposure

No chemical-specific postapplication human reentry or transferable residue data were submitted in support of the reregistration of trichlorfon. Therefore, a surrogate postapplication exposure assessment was conducted to determine potential risks for the representative scenarios. EPA has determined that there are potential postapplication exposures to occupational workers in the following scenarios: mowing/maintaining golf course turfgrass; and cutting, harvesting, transplanting, pruning, balling/burlapping, irrigating, and sorting/packing nursery-grown ornamentals. The transferable residues on the turf were assessed at five percent of the application rate as cited in the disciplinary chapter. The ornamental DFR values were assumed to be 20 percent of the application rate. Transfer coefficients used in the assessment are standard values used by HED. The transfer coefficients are 1,000 cm^2/hr for mowing/maintenance; 10,000 cm^2/hr for cutting, pruning, harvesting, transplanting, and balling ornamentals; 4,000 cm^2/hr for irrigating in ornamentals; and 2,500 cm^2/hr for sorting/packing ornamentals.

Details of the postapplication exposure and risk assessment for occupational workers are presented in the disciplinary chapter attached in the appendix. In summary, the risk assessment for occupational postapplication workers indicates that entry by golf course workers to mow and maintain the turfgrass on the day of application the MOE are greater than 100. However, entry by workers in ornamental nurseries following treatments at the 3 lb ai/acre application rate do not reach a MOE of 100 until day 20 for cutting, harvesting, transplanting, pruning, or balling/ burlapping; until day 11 for irrigating; and until day 7 for sorting and packing. Furthermore, entry by workers in ornamental nurseries following treatments at the 6 lb ai/acre application rate do not reach a MOE of 100 until day 26 for cutting, harvesting, transplanting, pruning, balling/- burlapping; until day 18 for irrigating; and until day 13 for sorting and packing.

4.3.2 Incident Information

The following low effect levels have been reported in human studies:

1. In China workers exposed to 0.5 mg/m^3 experience reduced plasma cholinesterase (Hu et al. 1986).
2. Doses of 7.5 mg/kg given 2-4 times at two-week intervals, caused cholinesterase inhibition, weakness, nausea, diarrhea, and abdominal pain (Wegner 1970).
3. In a clinical trial weekly oral doses (for 1-3 months) of 5 mg/kg led to 60% depression of red blood cell cholinesterase and 80% depression of plasma with symptoms of nausea, vomiting, and/or diarrhea in some patients. No significant effects, were reported at 2.5 mg/kg, however.
4. Though not conclusive, strong evidence from Hungary suggests birth defects in women ingesting 100 mg/kg of trichlorfon.

Relatively few incidents of illness have been reported due to trichlorfon based on the Incident Data System, Poison Control Center Data, or the California Pesticide Illness Surveillance Program. According to the above literature reports where humans were administered doses of trichlorfon, 5 mg/kg was the associated dose with persons experiencing symptoms such as red cell

cholinesterase, plasma cholinesterase depression, nausea, vomiting, and/or diarrhea.

Measures to reduce exposure to applicators and handlers of trichlorfon should be consistent with other organophosphate and carbamates. Domestic food uses of trichlorfon have already been canceled.

4.3.3 Residential Handler Exposure

Potential trichlorfon residential use sites include lawns and perimeters of homes. Residential handler exposure to trichlorfon residues via dermal and inhalation routes can occur during handling, mixing, loading, and applying activities. The exposure duration of these activities was classified as short-term (1-7 days) because trichlorfon is not expected to be used more than 7 consecutive days by a homeowner.

4.3.3.1 Residential Handler Exposure Scenarios

Four handler scenarios were assessed for residential handlers: (R1) loading/applying granules to building perimeters using a "push-type" broadcast spreader; (R2) loading/applying granules to residential lawns using a "push-type" broadcast spreader; (R3) applying granules to building perimeters using "hand broadcast" method; (R4) applying granules to ant mounds using "hand broadcast" method.

4.3.3.2 Residential Handler Exposure Data Sources and Assumptions

Residential handler exposure assessments were completed by HED assuming an exposure scenario for homeowners wearing the following attire: short sleeved shirt, short pants, shoes and socks, and no gloves or respirator. PHED values used to estimate daily unit exposure values were taken from the *Standard Operating Procedures (SOPs) for Residential Exposure Assessments (December 1997).*

The area treated per day was assumed to be 0.5 acres for turf broadcast applications, 700 sq. ft. for home perimeter treatments, and 5 ant mounds to be treated by hand using the granular formulation. Calculations were made using a range of application rates including the maximum application rates available on the labels. Application rates represent the range of exposure levels associated with the various use patterns.

4.3.3.3 Residential Handler Risk Characterization

Because the same toxic effects were selected for the assessment of dermal and inhalation risks, a combined total risk assessment was conducted for dermal and inhalation exposures. MOEs for residential handlers were derived based upon comparison of dermal exposure estimates against the short-term NOAEL of 100 mg/kg/day from a 21-day dermal rabbit study and an inhalation NOAEL of 0.0127 mg/L (3.45 mg/kg/day) from a 21-day inhalation study in rats. The short - term NOAELs were from route specific studies, and therefore, an absorption correction is not necessary. The uncertainty factor and target MOE for residential assessments is 1,000 (extra 10x

is the FQPA factor) for short-term dermal and inhalation risks. MOEs below this level would represent a risk concern for the Agency.

A summary of the short-term risk estimates for homeowners is presented in Table 11. Specific dose levels and MOEs for dermal, inhalation, and total exposure/risk are presented in the disciplinary chapter attached as an appendix. Residential dermal unit exposure represent short pants, short sleeved shirt, no gloves, and open mixing/loading.

Short-Term Risk Characterization: The estimates for short-term dermal and inhalation risks have been combined because dermal and inhalation endpoint effects are the same. MOEs are greater than 1000 for loading/applying granules to building perimeters using a "push-type" broadcast spreader; loading/applying granules to residential lawns using a "push-type" broadcast spreader (minimum rate only); and applying granules to building perimeters using "hand broadcast" method (minimum rate only). The MOEs are less than 1,000 for loading/applying granules to residential lawns using a "push-type" broadcast spreader; applying granules to building perimeters using "hand broadcast" method (maximum rate); and applying granules to ant mounds using "hand broadcast" method.

Table 11. Baseline Residential Dermal, Inhalation, and Total MOEs for Trichlorfon

Exposure Scenario (Scen. #)	Dermal Unit Exposure[a] (mg/lb ai)	Inhalation Unit Exposure[b] (μg/lb ai)	Crop Type or Use[c]	Application Rate[d] (lb ai/acre)	Amount Handled per Day[e]	Dermal[f,g]		Inhalation[h,i]		Combined[j,k]	
						Daily Dose[f] (mg/kg/day)	MOE[g] (1,000 needed)	Daily Dose[h] (mg/kg/day)	MOE[i] (1,000 needed)	Daily Dose[j] (mg/kg/day)	MOE[k] (1,000 needed)
Mixer/Loader/Applicator Risks											
Loading/Applying with a Push Type Spreader (R1)	3.0	6.3	perimeter	0.000062 lb ai/ft^2	700 ft^2	0.0019	54,000	3.9E-06	880,000	0.0019	51,000
				0.0000125 lb ai/ft^2		0.00040	270,000	7.9E-07	4,400,000	0.00040	250,000
Loading/Applying with a Push Type Spreader (R2)			turf	8.2 lb ai/acre	0.5 acres	0.18	570	3.7E-04	9,300	0.18	540
				5.4 lb ai/acre		0.12	860	2.4E-04	14,000	0.12	810
Applying Granulars by Hand (R3)	430	470	perimeter	0.000050 lb ai/ft^2	700 ft^2	0.22	470	2.4E-04	15,000	0.22	450
				0.0000125 lb ai/ft^2		0.054	1,900	5.9E-05	59,000	0.054	1,800
Applying Granulars by Hand (R4)			Texas Harvester ant mounds	0.025 lb ai/mound	5 ant mounds	0.77	130	8.4E-04	4,100	0.77	130
				0.013 lb ai/mound		0.40	250	4.4E-04	7,900	0.40	240

Footnotes:

a Dermal unit exposure values from Residential SOPs draft December 1997. Baseline dermal exposure assumes short pants, short sleeved shirt, and no gloves clothing scenario.

b Inhalation unit exposure values from Residential SOPs draft December 1997 (no respirator).

c Crop type or use

d Application rates are the high and low application rates presented on EPA registered labels. Rates are taken from the following labels:
R1: perimeter 3125-400 and 655-791; turf, 3125-507 and 3125-400, and
R2: perimeter 655-790 and 655-791; and mounds 655-791.

e Amount handled per day values are EPA estimates of acreage treated found in the Residential SOPs draft December 1997. Perimeter area treated is based on a house 30 x 40 x 30 x 40 feet and a 5 foot wide band. A 5 mound estimate was based on communications with Dr. Mark Dow, RD.

f Dermal daily dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) / body weight (70 kg).

g Dermal MOE = NOAEL (100 mg/kg) / daily dose (mg/kg/day).

h Inhalation daily dose (mg/kg/day) = inhalation unit exposure (μg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x conversion factor (1 mg/1,000 μg) / body weight (70 kg).

I Inhalation MOE = NOAEL (3.45 mg/kg/day) / daily dose (mg/kg/day).

j Total dermal dose = daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day)

k Total MOE = 1 / [(1 / dermal MOE) + (1 / inhalation MOE)].

4.3.3.4 Residential Postapplication Exposures and Risks

EPA has determined that there are potential postapplication exposures to residents entering treated lawns. There is a potential for dermal and inadvertent oral exposure to children from incidential ingestion of trichlorfon-treated lawns and/or granules. For residential postapplication activities, the exposure duration is expected to be short- to intermediate-term.

4.3.3.5 Postapplication Exposure Scenarios

EPA has determined that there are potential postapplication exposures to residents, including children, in the following scenarios.

- dermal postapplication risks to toddlers and adults from granular formulations when reentering treated lawns;
- dermal postapplication risks to toddlers and adults from soluble powder formulations when reentering treated lawns;
- oral postapplication risks to toddlers from "hand-to-mouth" (i.e., ingestion of grass, soil, granular pellets, or hand-to-mouth contact) exposure when reentering lawns treated with granular formulations;
- oral post application risks to toddlers from "hand-to-mouth" (i.e., ingestion of grass, soil, or hand-to-mouth contact) exposure when reentering lawns treated with soluble powder formulations; and
- golfer postapplication risks to youths (12 yrs) and adults while playing 18 holes of golf.

4.3.3.6 Data Sources and Assumptions for Postapplication Exposure Calculations

No chemical-specific postapplication human reentry or transferable residue data were submitted in support of the reregistration of trichlorfon. Therefore, post-application exposures to residents were estimated using assumptions from the Standard Operating Procedures (SOPs) for Residential Exposure Assessments. In addition to the high-end estimates from the SOPs, a low end estimate has been included as a range finder. The following general assumptions were made for all scenarios:

- On the day of application, it was assumed that 1 to 5 percent of the application rate is available from the turf as transferable residues.

- Postapplication exposure was assessed on the same day the pesticide is applied because it was assumed that adults and toddlers could enter the lawn immediately after application. Therefore, postapplication exposures were based on day 0.

- Adults were assumed to weigh 70 kg. The average body weight for a 12 year old youth is 44 kg. The 1 to 6 year old toddler is assumed to weigh 15 kg.

Specific details on the assumptions used in the estimates are available in the disciplinary chapter

attached as an appendix.

4.3.3.7 Residential Postapplication Risk Characterization

The calculations of dermal postapplication residential risks are presented in Table 12. MOEs exceed HED's level of concern for adults and toddlers while playing on treated lawns at both the low and maximum label application rates. However, MOEs do not exceed HED's level of concern for adults and youths playing 18 holes of golf on trichlorfon treated golf courses. The calculations of oral postapplication residential risks are presented in Table 13. MOEs do not exceed HED's level of concern for hand-to-mouth activity on the lawn at the lowest application rate examined, and incidential ingestion of treated grass and/or soil. This screening level assessment indicates a potential concern (i.e., MOEs less than 1,000) for the hand-to-mouth activity on the lawn at the maximum application rates currently permitted, and the potential ingestion of granules. While it is HED's policy to routinely conduct screening level assessments for incidental ingestion of granules from treated areas, HED did not have information on the granule size. Therefore, HED could not make a judgement as to the formulation particle size may be outside the scope of concern. HED recommends that the registrant provide quantitative information on the number of particles per gram (or particles per area) of formulated product applicable to the current inert carrier material.

Table 12. Dermal Postapplication Risks to Toddlers and Adults from Granular and Soluble Powder Formulations When Reentering Treated Lawns

Scenario	Range Finder[1]	Application Rate (lb ai/acre)	Conversion Factor (lb ai/acre to µg/cm^2)	Fraction of Residue Retained	Transfer Coefficient (cm^2/hr)	Exposure Duration (hours)	Body Weight (kg)	Daily Dermal Dose[2] (mg/kg/day)	Dermal MOE[3] (UF >1000)
Toddler	Low End	5.4	11.209	0.01	8,700	0.33	15	0.12	860
	High End	8.2	11.209	0.05	8,700	2	15	5.3	19
Adult	Low End	5.4	11.209	0.01	43,000	0.33	70	0.12	810
	High End	8.2	11.209	0.05	43,000	2	70	5.6	18
Golfer - Youth	Low End	5.4	11.209	0.01	100	4	44	0.0055	18,000
	High End	8.2	11.209	0.05	100	4	44	0.042	2,400
Golfer - Adult	Low End	5.4	11.209	0.01	100	4	70	0.0035	29,000
	High End	8.2	11.209	0.05	100	4	70	0.026	3,800

[1] Low end ranges are derived from the lowest labeled application rates (except for a single granular label that listed a low rate of 1.089 lb ai/A -- EPA Reg. 3125-400), an estimated retained residues of 1 percent of the application rate, and estimated hours exposed as 1/3 hours. The high end ranges are derived from the highest labeled rates, estimated retained residues of 5 percent of the application rate, and estimated hours exposed as 2 hours. Golfer durations are assumed to be 4 hours for an 18-hole round of golf.

[2] Daily Dermal Dose (mg/kg/day) = [Application rate (lb ai/acre) x conversion factor (µg/cm^2/lb ai per acre) x fraction of residue retained x Transfer Coefficient (cm^2/hr) x unit conversion (1 mg/1000 µg) x Exposure Duration (hrs/day)]/Body Weight (kg). Inputs and calculations are derived from the SOPs for Residential Exposure Assessments, except for golfers. A measured Golfer transfer coefficient is not available, and therefore, is estimated to be 100 cm^2/hr because of the low dermal contact activity (i.e., walking).

[3] Postapplication Dermal MOE = Dermal NOAEL (100 mg/kg/day)/Daily Dermal Dose (mg/kg/day). MOEs are reported to two significant figures; uncertainty factor (i.e., MOE) is 1,000.

Table 13. Oral Postapplication Risks to Toddlers from "Hand-to-Mouth" and Ingestion Exposure When Reentering Lawns Treated with Granular and Soluble Powder Formulations

Type of Exposure	Range Finder[1]	Application Rate (lb ai/acre)	Conversion Factor (lb ai/acre to µg/cm^2)	Fraction of Residue Retained	Ingestion Rate or Other Assumptions	Exposure Duration (hours)	Body Weight (kg)	Daily Oral Dose[2] (mg/kg/day)	Oral MOE [3] (UF >1,000)
Hand to Mouth[4]	Low End	5.4	11.209	0.01	350 cm^2 (hand surface area) 1.56 events/hr	0.33	15	0.0073	1,400
	High End	8.2		0.05		2		0.33	30
Grass[5]	Low End	5.4		0.01	25 cm^2/day	0.33		0.0010	9,900
	High End	8.2		0.05		2		0.0077	1,300
Soil[6]	Low End	5.4		100	100 mg/day ingestion & 0.67 cm^3/gm soil	0.33		0.00027	37,000
	High End	8.2		100		2		0.00041	24,000
Granules[7]	Low End	NA	NA	0.05	0.3 g/day	NA		1.0	10
	High End	NA		0.062		NA		1.2	8.1

Footnotes:

[1] Low end ranges are derived from the lowest labeled app. rates (except for a single granular label that listed a low rate of 1.089 lb ai/A -- EPA Reg. 3125-400), an estimated retained residues of 1 percent, and estimated hrs. exposed as 1/3 hours. High end ranges are derived from the highest labeled rates, estimated retained residues of 20 percent, and estimated hrs. exposed as 2 hrs.

[2] Daily Oral Dose (mg/kg/day) formulas are presented in the following footnotes. Inputs and calculations are derived from the SOPs for Residential Exposure Assessments.

[3] Postapplication oral MOE = Oral NOAEL(10 mg/kg/day)/Daily Oral Dose(mg/kg/day). Oral NOAEL determined from a rat study. MOEs are reported to two significant figures; an acceptable MOE is at least 1,000.

[4] **Hand-to-mouth** oral dose to toddlers on the day of treatment (mg/kg/day) = [application rate(lb ai/acre) x fraction of residue retained after application x 11.209 (conversion factor) x surface area hands (350 cm^2) x hand-to-mouth rate(1.56 events/hour) x exp. time (hr/day) x .001 mg/µg] ÷ 15 kg bw.

[5] **Grass** oral dose to toddlers on the day of treatment (mg/kg/day) = [application rate(lb ai/acre) x fraction of residue retained after application (5 or 1 %) x 4.54E+08 μg/lb conversion factor x 2.47E-08 acre/cm^2 conversion factor) x ingestion rate of grass (25 cm^2/day) x .001 mg/µg] ÷ 15 kg bw.

[6] **Soil** oral dose to toddlers on the day of treatment (mg/kg/day) = [(application rate(lb ai/acre) x fraction of residue retained on uppermost 1 cm of soil (100%) x 4.54E+08 μg/lb conversion factor x 2.47E-08 acre/cm^2 conversion factor x 0.67 cm^3/g soil conversion factor) x 100 mg/day ingestion rate x 1.0E-06 g/μg conversion factor] ÷ 15 kg bw.

[7] Oral dose to toddlers from **granular pellet ingestion** (mg/kg/day) = [Granule ingestion rate (0.3 g/day) x Fraction of ai of granule formulations x 1000mg/g] ÷ 15 kg bw.

5.0 AGGREGATE RISK ASSESSMENTS AND RISK CHARACTERIZATION

5.1 Acute Aggregate Risk

Acute aggregate risk estimates exceed HED's level of concern, primarily because of residues potentially present in surface water. An acute aggregate assessment estimates risk from one day's exposure to food and water. Acute exposure (food only) to trichlorfon was 17.6 % of the aPAD for the most highly exposed population subgroup (Children 1-6 yrs) which does not exceed HED's level of concern. This exposure assessment has been moderately refined in that adjustments have been made for the percent of beef imported. However, there is uncertainty in the residue levels used that cannot be addressed until additional data are received concerning the nature and magnitude of the residue. Since drinking water monitoring data for trichlorfon were not available, drinking water levels of comparison (DWLOCs) were calculated and compared to estimated environmental concentrations (EECs).

The EECs for groundwater (SCI-GROW) were less than the acute DWLOC's.

The EECs for surface water (GENEEC) were greater than the acute DWLOCs, indicating that acute aggregate exposure to trichlorfon exceeds HED's level of concern. The acute DWLOC for Children 1-6 years (highest exposed population) is 82 ppb and the acute DWLOC for the US Population is 312 ppb. The GENEEC surface water EEC is 1000 ppb. EFED used the highest application rate allowed on approved labels (8 lb ai/acre) to generate surface water (GENEEC) and groundwater (SCI-GROW) model EECs. Information on actual use rates and acreage treated were not available and therefore, only the maximum label rate (8 lb ai/acre rate) and maximum default acreage was used in the assessment. Also, there is no approved PRZM model scenario for turf therefore, refinement of the GENEEC (Tier 1) model estimate is not possible.

5.2 Short- and Intermediate Term Aggregate Risks

Aggregate short-term risk assessments provide estimates of risk resulting from residential exposures of 1-7 days duration plus average food and water exposures. Typically, high end residential exposure estimates are added to estimates of average food and water exposure for comparison to an appropriate NOAEL from a toxicity study. For trichlorfon, the short-intermediate term dermal toxicity endpoint is 100 mg/kg from a 21-day dermal rabbit toxicity study. The inhalation endpoint (any time period) is 0.0127 mg/L from a 21-day inhalation rat toxicity study. The dermal and inhalation endpoints used were based on cholinesterase inhibition. The target MOE including the FQPA factor of 10x is 1,000 for both dermal and inhalation.

Each of the following short-term residential exposure scenarios equaled or exceeded the target MOE (1000) and were considered when aggregating with average food and water exposure.

Scenario #1 Turf Uses: Loading/Applying with a Push Type Spreader (Scenario R2 / 5.4 and 8.2 lb ai/acre rate) risk estimates exceeds HED's level of concern from both application and postapplication exposures. Further exposure from food and water would only increase the level of concern. Therefore, aggregation with chronic food and water exposure was no performed.

Scenario #2 Perimeter Treatment Uses: Applying trichlorfon granulars by hand (R3/ 0.0000125 lb ai/ft^2) to building perimeters results in an exposure which does not exceed HED's level of concern. When aggregated with chronic food and water exposure, a short term DWLOC of 155 ppb was calculated. The GENEEC model estimated an EEC of 161 ppb. Therefore, this scenario when aggregated with chronic food and water exposure slightly exceeds HED's level of concern when both trichlorfon and DDVP model estimates are used. However, using the GENEEC model estimate for trichlorfon only (DDVP excluded) results in an exposure when aggregated with chronic food and water exposure which does not exceed HED's level of concern.

Scenario #3 Youth (12 yrs. old) Golfer Exposure: Dermal postapplication exposure is possible for adults and youths playing 18 holes of golf on trichlorfon treated golf courses. Dermal postapplication exposure to a youth golfer at the 8.2 lb ai/acre rate aggregated with chronic food and water exposure exceeds HED's level of concern when compared with the GENEEC surface water estimates. Dermal postapplication exposure to a youth golfer at the 5.4 lb ai/acre rate when aggregated with chronic food and water exposure results in a short term DWLOC of 207 ppb which when compared to the GENEEC model estimate of 161 does not exceed HED's level of concern.

Scenario #2 Applying Granulars by Hand to Perimeter (0.0000125 lb ai/ft^2)

MOE_{food} [a]	$1/MOE_{food}$	$MOE_{dermal+ inhalation}$	$1/MOE_{dermal + inhalation}$	MOE_{water}	$Exposure_{water}$
435,000	0.0000023	1,800 [b]	0.000556	2260	0.004425

[a] Acute dietary NOAEL ÷ chronic dietary exposure for males (20 yrs. +) = 10 mg/kg/day ÷ 0.000023mg/kg/day
[b] Combined MOE for Scenario R3 (Table 11) at 0.0000125 lb/ft^2

$$MOE_{water} = 1 / \ [1/1000 - (1/MOE_{food} + 1/MOE_{dermal+inhalation})] = 2260$$

$$Exposure_{water} = \frac{\text{Short-term NOAEL}}{MOE_{water}} = \frac{10}{2260} = 0.004425 \text{ mg/kg/day}$$

$$\text{Short-term DWLOC (ppb)} = \frac{Exposure_{water} * \text{body weight (kg)}}{\text{consumption (L)} * 0.001} = \frac{0.004425 * 70}{2 * 0.001}$$

Short-term DWLOC (ppb)(adult males) = 155 ppb (adult males)

Scenario #3 Youth Golfer (Application rate = 5.4 lb ai/acre)

MOE_{food} [a]	$1/MOE_{food}$	MOE_{dermal}	$1/MOE_{dermal}$	MOE_{water}	$Exposure_{water}$
330,000	0.0000030	18,000 [b]	0.0000556	1060	0.0094

[a] Acute dietary NOAEL ÷ chronic dietary exposure for males (13-19yrs) = 10 mg/kg/day ÷ 0.00003mg/kg/day
[b] Dermal MOE Golfer - Youth (Low End) Table 12

$MOE_{water} = 1 / [1/1000 - (1/MOE_{food} + 1/MOE_{dermal+inhalation})] = 1060$

$$Exposure_{water} = \frac{\text{Short-term NOAEL}}{MOE_{water}} = \frac{10}{1060} = 0.0094 \text{ mg/kg/day}$$

$$\text{Short-term DWLOC (ppb)} = \frac{Exposure_{water} * \text{body weight (kg)}}{\text{consumption (L)} * 0.001} = \frac{0.0094 * 44}{2 * 0.001}$$

Short-term DWLOC (ppb)(youth) = 207 ppb(youth)

5.3 Chronic (Non-Cancer) Aggregate Risk

A chronic aggregate assessment estimates risk from long term exposure to food and water, and also includes residential exposure if any long term scenarios are identified. No chronic residential use scenarios for trichlorfon were identified. Exposure (food only) to residues of trichlorfon based on Tier 2 refinement using reassessed tolerance levels and percent of beef/veal imported, represents 24.3% of the chronic PAD for the most highly exposed population subgroup (Children 1-6 yrs). Using conservative screening level models, the estimated levels of trichlorfon (using 3 applications/year) in groundwater (SCI-GROW) is 0.27 μg/L and in surface water (GENEEC) is 161 μg/L.

The EECs for surface water (GENEEC) were greater than the chronic DWLOCs, indicating that chronic aggregate exposure to trichlorfon exceeds HED's level of concern when surface water is the source of drinking water.

The EECs for groundwater (SCI-GROW) were less than the chronic DWLOC's, indicating that chronic aggregate exposure to trichlorfon is less than HED's level of concern when groundwater is the source of drinking water.

Data Requirements:

Product chemistry:

98% T (EPA Reg.# 3125-9) - 830.7050 UV/Visible Absorption

Residue chemistry:

The nature of the residue is not adequately understood (T. Morton, D244279). Additional data is required pertaining to the nature of the residue in animals (dermal treatment). Additional data may be required for storage stability, magnitude of residue in cattle (dermal treatment), and analytical method if additional residues of concern other than trichlorfon *per se* are determined by the HED Metabolism Assessment Review Committee.

The registrant is required to explain the difference between concentration of trichlorfon *per se* found in the magnitude of residue study and that which was found in the nature of the residue study.

Toxicology:

Prenatal developmental toxicity study in rats
Developmental neurotoxicity study in rats